VIDEO

Video Technology

Project Leader: Edward Kelley

Staff: 4.2 Professionals

Funding level: $0.7 M

Funding sources: NIST (100%)

Objective: Develop the measurement support needed by U.S. industry to process, transmit, and display digital video information. Initially, develop objective measures for the characterization of the video quality of display devices, including needed measurements for quantities such as gray scale linearity, uniformity, contrast ratio, viewing angle, and brightness. Similarly, develop a collection of measurement tools for the evaluation of digital video signals, that are subjected to compression processing, which will allow the user to apply an appropriate subset of the tools to obtain an overall quality figure consistent with the task requirements.

Background: Manufacturers of flat-panel displays and manufacturers who use flat-panel displays in their products need consistent, industry-accepted measurement standards for characterizing the performance of their displays. Standards or testing procedures presently existing in industry are in their infancy or nonexistent. The lack of standards restricts the U.S. electronics industry by reducing competition between the suppliers of display products. The current world market for displays is over $11 billion per year. Also, service and manufacturing industries providing, or interested in providing, digital video services or products need test measures for evaluating the quality of their video “product.” There are at present no metrologically sound measures for characterizing the quality of digital video sequences processed by lossy signal compression methods and/or transmitted over digital networks. Such characterization is fundamental to product development and marketing (price/performance targeting).

As a neutral third party, NIST is uniquely positioned to develop non-proprietary measurement tools that do not favor one technology. Further, NIST's long involvement with voluntary standards organizations, and our metrological reputation within those organizations, permit us to cooperate effectively with industrial partners and have NIST-developed technology widely accepted.

Current Tasks:

1. Develop performance measurements for the objective characterization of flat panel displays

   FY 1993 Designed measurement laboratory and ordered equipment, including colorimeters, spectroradiometers, charge-coupled-device (CCD) imaging

system, signal generators, display positioning system, and spherical panel surround.

FY 1994 Assembled and tested laboratory equipment; Developed test procedures for calibrating instruments; Developed simulation and modeling programs for the Princeton Engine, a massively parallel video supercomputer, to visually simulate display performance.

FY 1995 Conducted and reported on a survey of Display Measurement Standards; Developed additional creative laboratory calibration procedures; Completed round-robin measurement using a cathode-ray-tube (CRT) display from the National Information Display Laboratory; Started evaluation of an international voluntary reflectance measurement standard.

FY 1996 Analyzed and reported on an international voluntary reflectance measurement standard; Continued development of measurement techniques for display characterization; Designed a transportable display simulator; Investigated the use of interference filters to evaluate colorimetric performance of detection systems; Developed a flat panel display characterization draft standard for the Video Electronics Standards Association (VESA).

FY 1997 Continue development of measurement procedures for display characterization, adding additional tests for viewing angle and other parameters to meet industry needs; Begin correlation of objective measures with subjective human visual system perception; Complete the flat panel display characterization standard for the Video Electronics Standards Association (VESA).

FY 1998 Refine measurement procedures and continue correlation with subjective perception; Develop rapid display-testing procedures for “production line” speeds.

FY 1999 Conclude measurement development; Publish measurement procedures document (possibly in conjunction with a voluntary standards organization).

2. Develop video quality metrics for quantifying video compression and viewing artifacts

FY 1993 Implemented and analyzed quality metrics for telecommunications applications; Developed a family of video test patterns for qualifying and verifying performance of metric implementations.

FY 1994 Developed an interactive method to use the Princeton Engine to measure perceptible noise threshold in video images; Held industry workshop to highlight technical issues with respect to sending video over information networks; Purchased, installed, and developed tools for additional computing capability to support video quality metric research.

FY 1995 Performed experiment to estimate flicker perception for small text fonts on interlaced displays; Collaborated with industry partner to analyze performance issues related to noise filtering and blurring of video images; Helped develop Advanced Technology Program focused program on “Digital Video in Information Networks;” Prepared assessment of industry needs for video quality metrics.

FY 1996 Reported results of font flicker metric for interlaced displays; Developed performance revealing test patterns for digital video compression systems, including test for motion estimation characterization; Developed analysis tools to quantify generated errors.

FY 1997	Refine FY 1996 test patterns and extend by developing a transient effects detector and a pre-processing performance analyzer; Refine analysis tools to more closely correspond to human visual system perception.
FY 1998	Complete transfer of measurement technology to industry through publication and dissemination of test patterns and objective metrics.